## SEQUENCE LISTING

<110> THE GOVERNMENT OF THE UNITED STATES OF AMERICA AS REPRESENTED BY THE SECRETARY OF THE DEPARTMENT OF HEALTH AND HUMAN SERVICES, CENTERS FOR DISEASE CONTROL AND PREVENTION Lal, Renu B.
Owen, Sherry M.

- <120> IMMUNOGENIC HIV-1 MULTI-CLADE, MULTIVALENT CONSTRUCTS AND METHODS OF THEIR USE
- <130> 6395-67675
- <150> US 60/458,880
- <151> 2003-03-28
- <160> 64
- <170> PatentIn version 3.2
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- <212> DNA
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10

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30

Lys Glu Gly Ile Pro Pro Asp Gln Gln Arg Leu Ile Phe Ala Gly Lys 35 40 45

25

Gln Leu Glu Asp Gly Arg Thr Leu Ser Asp Tyr Asn Ile Gln Lys Glu 50 55 60

Ser Thr Leu His Leu Val Leu Arg Leu Arg Gly Ala Glu Leu Arg Ser 65 70 75 80

Leu Tyr Asn Thr Val Ala Thr Leu Tyr Cys Val His Gln Arg Ile Lys
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Ile Arg Leu Arg Pro Gly Gly Lys Lys Lys Tyr Trp Ala Ser Arg Glu
100 105 110

Leu Glu Arg Phe Lys Ala Ala Ile Ser Pro Arg Thr Leu Asn Ala Trp
115 120 125

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Ala Leu Ser Glu Gly Ala Thr Pro Gln Asp Leu Asn Thr Met Thr Ser 145 150 155 160

Thr Leu Gln Glu Gln Ile Gly Trp Lys Ala Ala Asn Pro Pro Ile Pro 165 170 175

Val Gly Asp Ile Tyr Lys Arg Trp Ile Ile Leu Gly Leu Asn Lys Ile 180 185 190

Val Arg Met Tyr Ser Pro Thr Ser Ile Phe Arg Asp Tyr Val Asp Arg 195 200 205

Phe Tyr Lys Thr Leu Arg Ala Val Gln Asn Ala Asn Pro Asp Cys Lys 210 225 220

Thr Ile Leu Lys Ala Leu Ala Cys Gln Gly Val Gly Gly Pro Gly His 225 230 235 240

Lys Lys Ala Ala Ile Thr Leu Trp Gln Arg Pro Leu Val Thr Val Leu 245 250 255

Asp Val Gly Asp Ala Tyr Phe Ser Val Trp Lys Gly Ser Pro Ala Ile 260 265 270

Phe Gln Ser Lys Leu Arg Gly Pro Gly Arg Ala Phe Val Thr Ile Lys 275 280 285

Ala Ala Cys Thr Pro Tyr Asp Ile Asn Gln Met Leu Gly Thr Ser 290 295 300

Met Thr Lys Ile Leu Lys Glu Pro Val His Gly Val Lys Ala Ala Gln 305 310 315 320

Ile Tyr Gln Glu Pro Phe Lys Asn Leu Lys Thr Gly Glu Pro Ile Val 325 330 335

Gly Ala Glu Thr Phe Tyr Val Asp Gly Ala Ala Asn Val Ile Tyr Gln 340 345 350

Tyr Met Asp Asp Leu Leu Trp Lys Gly Glu Gly Ala Val Lys Ala 355 360 365

Ala Arg Ile Arg Thr Trp Lys Ser Leu Val Lys His Pro Lys Val Ser 370 380

Ser Glu Val His Ile Ala Val Arg His Phe Pro Arg Ile Trp Ala Val 385 390 395 400

Arg His Phe Pro Arg Pro Trp Ala Ile Ile Arg Ile Leu Gln Gln Leu
405 410 415

Lys Ala Ala Val Gly Phe Pro Val Arg Pro Gln Val Pro Leu Arg Pro 420 425 430

Met Thr Tyr Lys Gly Ala Val Asp Leu Ser His Phe Leu Lys Glu Lys 435 440 445

Gly Gly Leu Gly Pro Gly Val Arg Tyr Pro Leu Thr Phe Gly Trp Cys
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Tyr Lys Ala Ala Lys Thr Leu Pro Leu Cys Val Thr Leu Thr Val Tyr 465 470 475 480

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		ggc														384
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Trp Ala Ser Arg Glu Leu Glu Arg Phe Lys Ala Ala Ile Ser Pro Arg 35 40 45

Thr Leu Asn Ala Trp Val Lys Val Val Lys Ala Phe Ser Pro Glu Val 50 55 60

Ile Pro Met Phe Ser Ala Leu Ser Glu Gly Ala Thr Pro Gln Asp Leu 65 70 75 80

Asn Thr Met Thr Ser Thr Leu Gln Glu Gln Ile Gly Trp Lys Ala Ala 85 90 95

Asn Pro Pro Ile Pro Val Gly Asp Ile Tyr Lys Arg Trp Ile Ile Leu 100 105 110

Gly Leu Asn Lys Ile Val Arg Met Tyr Ser Pro Thr Ser Ile Phe Arg 115 120 125

Asp Tyr Val Asp Arg Phe Tyr Lys Thr Leu Arg Ala Val Gln Asn Ala 130 135 140

Asn Pro Asp Cys Lys Thr Ile Leu Lys Ala Leu Ala Cys Gln Gly Val 145 150 155 160

Gly Gly Pro Gly His Lys Lys Ala Ala Ile Thr Leu Trp Gln Arg Pro 165 170 175

Leu Val Thr Val Leu Asp Val Gly Asp Ala Tyr Phe Ser Val Trp Lys
180 185 190

- Gly Ser Pro Ala Ile Phe Gln Ser Lys Leu Arg Gly Pro Gly Arg Ala 195 200 205
- Phe Val Thr Ile Lys Ala Ala Ala Cys Thr Pro Tyr Asp Ile Asn Gln 210 215 220
- Met Leu Gly Thr Ser Met Thr Lys Ile Leu Lys Glu Pro Val His Gly 225 230 235 240
- Val Lys Ala Ala Gln Ile Tyr Gln Glu Pro Phe Lys Asn Leu Lys Thr 245 250 255
- Gly Glu Pro Ile Val Gly Ala Glu Thr Phe Tyr Val Asp Gly Ala Ala 260 265 270
- Asn Val Ile Tyr Gln Tyr Met Asp Asp Leu Leu Leu Trp Lys Gly Glu 275 280 285
- Gly Ala Val Lys Ala Ala Arg Ile Arg Thr Trp Lys Ser Leu Val Lys 290 295 300
- His Pro Lys Val Ser Ser Glu Val His Ile Ala Val Arg His Phe Pro 305 310 315 320
- Arg Ile Trp Ala Val Arg His Phe Pro Arg Pro Trp Ala Ile Ile Arg 325 330 335
- Ile Leu Gln Gln Leu Lys Ala Ala Val Gly Phe Pro Val Arg Pro Gln 340 345 350
- Val Pro Leu Arg Pro Met Thr Tyr Lys Gly Ala Val Asp Leu Ser His 355 360 365
- Phe Leu Lys Glu Lys Gly Gly Leu Gly Pro Gly Val Arg Tyr Pro Leu 370 375 380
- Thr Phe Gly Trp Cys Tyr Lys Ala Ala Lys Thr Leu Pro Leu Cys Val 385 390 395 400
- Thr Leu Thr Val Tyr Tyr Gly Val Pro Val Trp Lys Glu Ala Thr Thr 405 410 415
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Asp Gly Gly Leu 435

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Lys Glu Gly Ile Pro Pro Asp Gln Gln Arg Leu Ile Phe Ala Gly Lys 35 40 45

Gln Leu Glu Asp Gly Arg Thr Leu Ser Asp Tyr Asn Ile Gln Lys Glu 50 55 60

Ser Thr Leu His Leu Val Leu Arg Leu Arg Gly Ala Glu Leu Arg Ser 65 70 75 80

Leu Tyr Asn Thr Val Ala Thr Leu Tyr Cys Val His Gln Arg Ile Lys 85 90 95

Ile Arg Leu Arg Pro Gly Gly Lys Lys Lys Tyr Trp Ala Ser Arg Glu 100 105 110

Leu Glu Arg Phe Lys Ala Ala Ile Ser Pro Arg Thr Leu Asn Ala Trp
115 120 125

Val Lys Val Val Lys Ala Phe Ser Pro Glu Val Ile Pro Met Phe Ser 130 135 140

Ala Leu Ser Glu Gly Ala Thr Pro Gln Asp Leu Asn Thr Met Thr Ser 145 150 155 160

Thr Leu Gln Glu Gln Ile Gly Trp Lys Ala Ala Asn Pro Pro Ile Pro 165 170 175

Val Gly Asp Ile Tyr Lys Arg Trp Ile Ile Leu Gly Leu Asn Lys Ile 180 185 190

- Val Arg Met Tyr Ser Pro Thr Ser Ile Phe Arg Asp Tyr Val Asp Arg 195 200 205
- Phe Tyr Lys Thr Leu Arg Ala Val Gln Asn Ala Asn Pro Asp Cys Lys 210 215 220
- Thr Ile Leu Lys Ala Leu Ala Cys Gln Gly Val Gly Gly Pro Gly His 225 230 235 240
- Lys Lys Ala Ala Ile Thr Leu Trp Gln Arg Pro Leu Val Thr Val Leu 245 250 255
- Asp Val Gly Asp Ala Tyr Phe Ser Val Trp Lys Gly Ser Pro Ala Ile 260 265 270
- Phe Gln Ser Lys Leu Gly Thr Ser Met Thr Lys Ile Leu Lys Glu Pro 275 . 280 285
- Val His Gly Val Lys Ala Ala Gln Ile Tyr Gln Glu Pro Phe Lys Asn 290 295 300
- Leu Lys Thr Gly Glu Pro Ile Val Gly Ala Glu Thr Phe Tyr Val Asp 305 310 315 320
- Gly Ala Ala Asn Val Ile Tyr Gln Tyr Met Asp Asp Leu Leu Trp 325 330 335
- Lys Gly Glu Gly Ala Val Lys Ala Ala Arg Ile Arg Thr Trp Lys Ser 340 345 350
- Leu Val Lys His Pro Lys Val Ser Ser Glu Val His Ile Ala Val Arg 355 360 365
- His Phe Pro Arg Ile Trp Ala Val Arg His Phe Pro Arg Pro Trp Ala 370 375 380
- Ile Ile Arg Ile Leu Gln Gln Leu Lys Ala Ala Val Gly Phe Pro Val
  385 390 395 400
- Arg Pro Gln Val Pro Leu Arg Pro Met Thr Tyr Lys Gly Ala Val Asp
  405 410 415
- Leu Ser His Phe Leu Lys Glu Lys Gly Gly Leu Gly Pro Gly Val Arg

420 425 430

Tyr Pro Leu Thr Phe Gly Trp Cys Tyr Lys Ala Ala Lys Thr Leu Pro 435 440 445

Leu Cys Val Thr Leu Thr Val Tyr Tyr Gly Val Pro Val Trp Lys Glu 450 455 460

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Tyr Leu Lys Asp Gly Gly Leu 485

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Trp Ala Ser Arg Glu Leu Glu Arg Phe Lys Ala Ala Ile Ser Pro Arg 35 40 45

Thr Leu Asn Ala Trp Val Lys Val Val Lys Ala Phe Ser Pro Glu Val 50 55 60

Ile Pro Met Phe Ser Ala Leu Ser Glu Gly Ala Thr Pro Gln Asp Leu 65 70 75 80

Asn Thr Met Thr Ser Thr Leu Gln Glu Gln Ile Gly Trp Lys Ala Ala 85 90 95

Asn Pro Pro Ile Pro Val Gly Asp Ile Tyr Lys Arg Trp Ile Ile Leu 100 105 110

Gly Leu Asn Lys Ile Val Arg Met Tyr Ser Pro Thr Ser Ile Phe Arg 115 120 125

Asp Tyr Val Asp Arg Phe Tyr Lys Thr Leu Arg Ala Val Gln Asn Ala 130 135 140

- Asn Pro Asp Cys Lys Thr Ile Leu Lys Ala Leu Ala Cys Gln Gly Val 145 150 155 160
- Gly Gly Pro Gly His Lys Lys Ala Ala Ile Thr Leu Trp Gln Arg Pro 165 170 175
- Leu Val Thr Val Leu Asp Val Gly Asp Ala Tyr Phe Ser Val Trp Lys
  180 185 190
- Gly Ser Pro Ala Ile Phe Gln Ser Lys Leu Gly Thr Ser Met Thr Lys 195 200 205
- Ile Leu Lys Glu Pro Val His Gly Val Lys Ala Ala Gln Ile Tyr Gln 210 215 220
- Glu Pro Phe Lys Asn Leu Lys Thr Gly Glu Pro Ile Val Gly Ala Glu 225 230 235 240
- Thr Phe Tyr Val Asp Gly Ala Ala Asn Val Ile Tyr Gln Tyr Met Asp 245 250 255
- Asp Leu Leu Trp Lys Gly Glu Gly Ala Val Lys Ala Ala Arg Ile 260 265 270
- Arg Thr Trp Lys Ser Leu Val Lys His Pro Lys Val Ser Ser Glu Val 275 280 285
- His Ile Ala Val Arg His Phe Pro Arg Ile Trp Ala Val Arg His Phe 290 295 300
- Pro Arg Pro Trp Ala Ile Ile Arg Ile Leu Gln Gln Leu Lys Ala Ala 305 310 315 320
- Val Gly Phe Pro Val Arg Pro Gln Val Pro Leu Arg Pro Met Thr Tyr 325 330 335
- Lys Gly Ala Val Asp Leu Ser His Phe Leu Lys Glu Lys Gly Gly Leu 340 345 350
- Gly Pro Gly Val Arg Tyr Pro Leu Thr Phe Gly Trp Cys Tyr Lys Ala 355 360 365
- Ala Lys Thr Leu Pro Leu Cys Val Thr Leu Thr Val Tyr Tyr Gly Val

370 375 380

Pro Val Trp Lys Glu Ala Thr Thr Leu Arg Ala Ile Glu Ala Gln 385 390 395 400

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tgc cac Cys Glr 15	g gtg t 1 Val (	tgc tto Cys Phe	acc Thr 20	acc Thr	ggc Gly	ccc Pro	ggc Gly	ccc Pro 25	cgc Arg	cag Gln	cgc Arg	cgc Arg	cgc Arg 30	96
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ccc tgc Pro Cys 80	aac a Asn I	aag tgo Ys Cys	tac Tyr	tgc Cys 85	aag Lys	aag Lys	tgc Cys	tgc Cys	tac Tyr 90	cac His	tgc Cys	cag Gln	gtg Val	288
tgc ttc Cys Phe 95	ctg a Leu A	aac aat Asn Asn	ccc Pro 100	ggc Gly	aag Lys	cag Gln	cgc Arg	cgc Arg 105	ggc Gly	acc Thr	ccc Pro	cag Gln	agc Ser 110	336
aac aag Asn Lys	gac c Asp H	ac cag His Gln 115	aac Asn	ccc Pro	ggc Gly	cct Pro	gga Gly 120	ccc Pro	aac Asn	gag Glu	cag Gln	gac Asp 125	ctg Leu	384
ctg gcc Leu Ala	Leu A	ac aag sp Lys .30	tgg Trp	gcc Ala	aac Asn	ctg Leu 135	tgg Trp	aac Asn	tgg Trp	ttc Phe	gac Asp 140	atc Ile	agc Ser	432

aat Asn	ccc Pro	ggc Gly 145	gcc Ala	tgc Cys	aac Asn	acc Thr	tgc Cys 150	tac Tyr	tgc Cys	aag Lys	aag Lys	tgc Cys 155	agc Ser	tac Tyr	cac His	480
tgc Cys	ctg Leu 160	gtg Val	tgc Cys	ttc Phe	cag Gln	acc Thr 165	Gly	ccc Pro	ggc Gly	ccc Pro	cgc Arg 170	cag Gln	cgc Arg	cgc Arg	agc Ser	528
gcc Ala 175	ccc Pro	ccc Pro	agc Ser	agc Ser	gag Glu 180	gac Asp	cac His	cag Gln	aac Asn	ctg Leu 185	aat Asn	ccc Pro	G]Å aac	aac Asn	gag Glu 190	576
cag Gln	gag Glu	ctg Leu	ctg Leu	gag Glu 195	ctg Leu	gac Asp	aag Lys	tgg Trp	gcc Ala 200	agc Ser	ctg Leu	tgg Trp	aac Asn	tgg Trp 205	ttc Phe	624
gac Asp	atc Ile	acc Thr	ggc Gly 210	cca Pro	gga Gly	ccc Pro	cac His	gag Glu 215	cgc Arg	agc Ser	tac Tyr	atg Met	ttc Phe 220	agc Ser	gac Asp	672
ctg Leu	gag Glu	aac Asn 225	cgc Arg	tgc Cys	atc Ile	aac Asn	gag Glu 230	aag Lys	gac Asp	ctg Leu	ctg Leu	gcc Ala 235	ctg Leu	gac Asp	aag Lys	720
tgg Trp	cag Gln 240	aac Asn	ctg Leu	tgg Trp	agc Ser	tgg Trp 245	ttc Phe	gac Asp	atc Ile	acc Thr	aac Asn 250	cct Pro	ggc	agc Ser	ggc Gly	768
atc Ile 255	gtg Val	cag Gln	cag Gln	cag Gln	aac Asn 260	aac Asn	ctg Leu	ctg Leu	cgc Arg	gcc Ala 265	atc Ile	gag Glu	gcc Ala	cag Gln	cag Gln 270	816
cac His	ctg Leu	ctg Leu	cag Gln	ctg Leu 275	acc Thr	acc Thr	gtg Val	tgg Trp	ggc Gly 280	atc Ile	aag Lys	cag Gln	ctg Leu	cag Gln 285	gcc Ala	864
cgc Arg	atc Ile	ctg Leu	aat Asn 290	ccc Pro	ggc Gly	ggt Gly	cct Pro	gga Gly 295	cca Pro	tgg Trp	atg Met	gag Glu	tgg Trp 300	gac Asp	cgc Arg	912
gag Glu	atc Ile	aac Asn 305	aac Asn	tac Tyr	acc Thr	agc Ser	ctg Leu 310	atc Ile	cac His	agc Ser	ctg Leu	atc Ile 315	gag Glu	gag Glu	agc Ser	960
cag Gln	aac Asn 320	cag Gln	cag Gln	gag Glu	aag Lys	aac Asn 325	gag Glu	cag Gln	gag Glu	ctg Leu	ctg Leu 330	tct Ser	aga Arg	ccc Pro	gly aaa	1008
ggt Gly 335	acc Thr	atg Met	gcc Ala	ttc Phe	agc Ser 340	ccc Pro	gag Glu	gtg Val	atc Ile	ccc Pro 345	atg Met	ttc Phe	agc Ser	gcc Ala	ctg Leu 350	1056
agc Ser	gag Glu	ggc	gcc Ala	acc Thr 355	ccc Pro	cag Gln	gac Asp	ctg Leu	ccc Pro 360	atc Ile	gtg Val	cag Gln	aac Asn	atc Ile 365	cag Gln	1104
gly ggc	cag Gln	atg Met	gtg Val 370	cac His	cag Gln	gcc Ala	atc Ile	agc Ser 375	ccc Pro	cgc Arg	acc Thr	ctg Leu	aac Asn 380	gcc Ala	ggc Gly	1152

ccc Pro	ggc Gly	Pro 385	Leu	cag Gln	gag Glu	cag Gln	atc Ile 390	Gly	tgg Trp	atg Met	acc Thr	aac Asn 395	Asn	ccc Pro	ccc Pro	120	0
atc Ile	ccc Pro 400	Val	ggc	gag Glu	atc Ile	tac Tyr 405	aag Lys	ege Arg	tgg Trp	atc Ile	ato Ile 410	Leu	ggc	ctg Leu	aac Asn	124	8
aag Lys 415	Ile	gtg Val	cgc Arg	atg Met	tac Tyr 420	agc Ser	ccc Pro	acc Thr	agc Ser	atc Ile 425	Leu	gac Asp	atc Ile	cgc	cag Gln 430	129	6
ggc	ccc Pro	aag Lys	gag Glu	ccc Pro 435	ttc Phe	cgc Arg	gac Asp	tac Tyr	gtg Val 440	gac Asp	cgc Arg	ttc Phe	tac Tyr	aag Lys 445	gag Glu	134	4
atc Ile	tgc Cys	acc Thr	gag Glu 450	atg Met	gag Glu	aag Lys	gag Glu	ggc Gly 455	aag Lys	atc Ile	agc Ser	aag Lys	atc Ile 460	ggc	ccc Pro	139	2
ggc	ccc Pro	ggc Gly 465	ccc	ttc Phe	cgc Arg	aag Lys	tac Tyr 470	acc Thr	gcc Ala	ttc Phe	acc Thr	atc Ile 475	ccc Pro	agc Ser	atc Ile	144	0
aac Asn	aac Asn 480	gag Glu	agc Ser	ccc Pro	gcc Ala	atc Ile 485	ttc Phe	cag Gln	agc Ser	agc Ser	atg Met 490	acc Thr	aag Lys	atc Ile	ctg Leu	148	8
gag Glu 495	ccc Pro	tgg Trp	gag Glu	ttc Phe	gtg Val 500	aac Asn	acc Thr	ccc Pro	ccc Pro	ctg Leu 505	gtg Val	aag Lys	ctg Leu	tgg Trp	tac Tyr 510	153	6
cag Gln	aag Lys	acc Thr	gcc Ala	gtg Val 515	cag Gln	atg Met	gcc Ala	gtg Val	ttc Phe 520	atc Ile	cac His	aac Asn	ttc Phe	аад <b>L</b> ув 525	cgc Arg	1584	4
cag Gln	aag Lys	cag Gln	atc Ile 530	acc Thr	aag Lys	atc Ile	cag Gln	aac Asn 535	ttc Phe	cgc Arg	gtg Val	tac Tyr	tac Tyr 540	cgc Arg	ggc	1632	2
ccc Pro	gly ggc	ccc Pro 545	cag Gln	ctg Leu	ctg Leu	ttc Phe	atc Ile 550	cac His	ttc Phe	cgc Arg	tcg Ser	cgc Arg 555	cag Gln	cgg Arg	cgg Arg	1680	)
cgg Arg	cgg Arg 560	tac Tyr	agc Ser	agc Ser	ttg Leu	atc Ile 565	agg Arg	cgc Arg	acg Thr	gtg Val	cgg Arg 570	atc Ile	agc Ser	tcc Ser	tcg Ser	1728	3
tcg Ser 575	cgg Arg	ctg Leu	tgg Trp	cgg Arg	cag Gln 580	ccg Pro	atg Met	cgg Arg	aag Lys	tgg Trp 585	atg Met	aac Asn	agc Ser	agc Ser	atc Ile 590	1776	5
agc Ser	ggc Gly	ccc Pro	Gly	ccc Pro 595	gac Asp	atg Met	cgc Arg	gac Asp	aac Asn 600	tgg Trp	cgc Arg	agc Ser	gag Glu	ctg Leu 605	tac Tyr	1824	ŧ
aag Lys	tac Tyr	aag Lys	gtg Val 610	cag Gln	cag Gln	cac His	Leu	ctg Leu 615	cag Gln	ctg Leu	acc Thr	gtg Val	tgg Trp 620	ggc	atc Ile	1872	•
aag	cag	ctg	gcc	agc	ctg	tgg	aac	tgg	ttc	gac	atc	acc	aac	tgg	ctg	1920	ı

Lys	Gln	Leu 625	Ala	Ser	Leu	Trp	Asn 630	Trp	Phe	Asp	Ile	Thr 635	Asn	Trp	Leu	
tgg Trp	tac Tyr 640	atc Ile	aag Lys	atc Ile	ttc Phe	atc Ile 645	atg Met	atc Ile	gtg Val	ggc	ggc Gly 650	ctg Leu	atc Ile	ggc Gly	ctg Leu	1968
cgc Arg 655	cac His	atc Ile	ccc Pro	cgc Arg	cgc Arg 660	atc Ile	cgc Arg	cag Gln	Gly	ctg Leu 665	gag Glu	cgc Arg	gcc Ala	ctg Leu	agg Arg 670	2016
gca Ala	gca Ala	tgg Trp	acg Thr	agg Arg 675	gca Ala	ccg Pro	ccg Pro	acg Thr	agc Ser 680	gcg Ala	ccc Pro	ccc Pro	cgc Arg	ggc Gly 685	cag Gln	2064
ggc	agc Ser	atg Met	gac Asp 690	gag Glu	ggc	acc Thr	gcc Ala	gac Asp 695	gag Glu	Arg, cgc	gcc Ala	ccc Pro	ctg Leu 700	atc Ile	cgc Arg	2112
acc Thr	tga	gttt	aaac	:												2126

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<211> 703 <212> PRT

<213> Artificial Sequence

<220>

<223> Construct encoding polyepitope polypeptide.

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Val Cys Phe Thr Thr Gly Pro Gly Pro Arg Gln Arg Arg Arg Ala Pro 20 30

Gln Asp Ser Gln Thr His Gln Val Ser Val Tyr Tyr Ala Ala Ala Gln 35 40

Trp Asp Phe Gly Asn Thr Met Cys Gln Ile Asn Pro Gly Arg Ser Gln 50

Lys Glu Gly Leu His Tyr Thr Cys Val Tyr Gly Pro Gly Pro Pro Cys 70 75

Asn Lys Cys Tyr Cys Lys Lys Cys Cys Tyr His Cys Gln Val Cys Phe 85 90

Leu Asn Asn Pro Gly Lys Gln Arg Arg Gly Thr Pro Gln Ser Asn Lys 100 105

Asp His Gln Asn Pro Gly Pro Gly Pro Asn Glu Gln Asp Leu Leu Ala 115 120 125

- Leu Asp Lys Trp Ala Asn Leu Trp Asn Trp Phe Asp Ile Ser Asn Pro 130 135 140
- Gly Ala Cys Asn Thr Cys Tyr Cys Lys Lys Cys Ser Tyr His Cys Leu 145 150 155 160
- Val Cys Phe Gln Thr Gly Pro Gly Pro Arg Gln Arg Arg Ser Ala Pro 165 170 175
- Pro Ser Ser Glu Asp His Gln Asn Leu Asn Pro Gly Asn Glu Gln Glu 180 185 190
- Leu Leu Glu Leu Asp Lys Trp Ala Ser Leu Trp Asn Trp Phe Asp Ile 195 200 205
- Thr Gly Pro Gly Pro His Glu Arg Ser Tyr Met Phe Ser Asp Leu Glu 210 215 220
- Asn Arg Cys Ile Asn Glu Lys Asp Leu Leu Ala Leu Asp Lys Trp Gln 225 230 235 240
- Asn Leu Trp Ser Trp Phe Asp Ile Thr Asn Pro Gly Ser Gly Ile Val 245 250 255
- Gln Gln Gln Asn Asn Leu Leu Arg Ala Ile Glu Ala Gln Gln His Leu 260 265 270
- Leu Gln Leu Thr Thr Val Trp Gly Ile Lys Gln Leu Gln Ala Arg Ile 275 280 285
- Leu Asn Pro Gly Gly Pro Gly Pro Trp Met Glu Trp Asp Arg Glu Ile 290 295 300
- Asn Asn Tyr Thr Ser Leu Ile His Ser Leu Ile Glu Glu Ser Gln Asn 305 310 315 320
- Gln Gln Glu Lys Asn Glu Gln Glu Leu Leu Ser Arg Pro Gly Gly Thr 325 330 335
- Met Ala Phe Ser Pro Glu Val Ile Pro Met Phe Ser Ala Leu Ser Glu 340 345 350

Gly Ala Thr Pro Gln Asp Leu Pro Ile Val Gln Asn Ile Gln Gly Gln 355 360 365

- Met Val His Gln Ala Ile Ser Pro Arg Thr Leu Asn Ala Gly Pro Gly 370 380
- Pro Leu Gln Glu Gln Ile Gly Trp Met Thr Asn Asn Pro Pro Ile Pro 385 390 395 400
- Val Gly Glu Ile Tyr Lys Arg Trp Ile Ile Leu Gly Leu Asn Lys Ile 405 410 415
- Val Arg Met Tyr Ser Pro Thr Ser Ile Leu Asp Ile Arg Gln Gly Pro 420 425 430
- Lys Glu Pro Phe Arg Asp Tyr Val Asp Arg Phe Tyr Lys Glu Ile Cys 435 440 445
- Thr Glu Met Glu Lys Glu Gly Lys Ile Ser Lys Ile Gly Pro Gly Pro 450 455 460
- Gly Pro Phe Arg Lys Tyr Thr Ala Phe Thr Ile Pro Ser Ile Asn Asn 465 470 475 480
- Glu Ser Pro Ala Ile Phe Gln Ser Ser Met Thr Lys Ile Leu Glu Pro 485 490 495
- Trp Glu Phe Val Asn Thr Pro Pro Leu Val Lys Leu Trp Tyr Gln Lys 500 505 510
- Thr Ala Val Gln Met Ala Val Phe Ile His Asn Phe Lys Arg Gln Lys 515 520 525
- Gln Ile Thr Lys Ile Gln Asn Phe Arg Val Tyr Tyr Arg Gly Pro Gly 530 535 540
- Pro Gln Leu Leu Phe Ile His Phe Arg Ser Arg Gln Arg Arg Arg 545 550 555 560
- Tyr Ser Ser Leu Ile Arg Arg Thr Val Arg Ile Ser Ser Ser Arg 565 570 575
- Leu Trp Arg Gln Pro Met Arg Lys Trp Met Asn Ser Ser Ile Ser Gly 580 585 590
- Pro Gly Pro Asp Met Arg Asp Asn Trp Arg Ser Glu Leu Tyr Lys Tyr

> 595 600 605

Lys Val Gln Gln His Leu Leu Gln Leu Thr Val Trp Gly Ile Lys Gln

Leu Ala Ser Leu Trp Asn Trp Phe Asp Ile Thr Asn Trp Leu Trp Tyr 635

Ile Lys Ile Phe Ile Met Ile Val Gly Gly Leu Ile Gly Leu Arg His 650

Ile Pro Arg Arg Ile Arg Gln Gly Leu Glu Arg Ala Leu Arg Ala Ala

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<210> 9

<211> 2063 <212> DNA

<213> Artificial Sequence

<220>

<223> Construct encoding polyepitope polypeptide.

<220>

<221> CDS

<222> (7)..(2061)

<223> Sequence encoding MCMVABTh polyepitope polypeptide.

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Cys Gln Val Cys Phe Thr Thr Gly Pro Gly Pro Arg Gln Arg Arg Arg 96

gcc ccc cag gac agc cag acc cac cag gtg agc gta tac tac gcc gcc Ala Pro Gln Asp Ser Gln Thr His Gln Val Ser Val Tyr Tyr Ala Ala 144

gcc cag tgg gac ttc ggc aac acc atg tgc cag atc aat ccc ggc cgc 192 Ala Gln Trp Asp Phe Gly Asn Thr Met Cys Gln Ile Asn Pro Gly Arg

age cag aag gag gge etg cac tac ace tge gta tac gge cce gge cce 240 Ser Gln Lys Glu Gly Leu His Tyr Thr Cys Val Tyr Gly Pro Gly Pro 65 70

ccc Pro	tgo Cys 80	aac Asr	aag Lys	g tgo Gyf	tac Tyr	tgo Cys 85	c aag	g aag	g tg	c tg	c ta s Ty 90	r Hi	c tg s Cy	c ca s Gl	g gtg n Val	2	88
95	1.110	. Deu	ASI	L ASI	100	) o GT <sup>2</sup>	ν	s Gli	ı Arg	10!	g Gl	y Thi	r Pr	o Gl	g agc n Ser 110		36
aac Asn	aag Lys	gac Asp	Cac His	Gln 115	I ASI	ecc Pro	ggo gly	c cct / Pro	998 Gly	Pro	c aac o Asi	c gag n Glu	g caq ı Glı	g ga n Asj 12:	c ctg p Leu 5	3	84
200	ALG	пец	130	пув	Trp	ATa	Asn	135	Trp	) Asr	ı Trı	Ph∈	2 Asp 14(	) )	c agc e Ser	4:	32
11011	110	145	nia	Cys	ASII	ınr	150	Tyr	Cys	Lys	Lys	155	Ser	Туз	c cac His	4.8	80
tgc Cys	ctg Leu 160	gtg Val	tgc Cys	ttc Phe	cag Gln	acc Thr 165	ggc	ccc Pro	ggc	ccc Pro	Arg	j Gln	cgc Arg	cgo Arg	agc Ser	52	28
gcc Ala 175	ccc Pro	ccc Pro	agc Ser	agc Ser	gag Glu 180	gac Asp	cac His	cag Gln	aac Asn	ctg Leu 185	aat Asn	ccc Pro	Gly	aac Asn	gag Glu 190	57	76
GIII	GIU	пеп	тец	195	ьeu	Asp	ГЛS	Trp	Ala 200	Ser	Leu	Trp	Asn	Trp 205		62	4
110p	110	1111	210	PLO	GIĀ	Pro	HIS	G1u 215	Arg	Ser	Tyr	atg Met	Phe 220	Ser	Asp	67	2
200	O.L.	225	ALG	Сув	тте	ASN	230	ràs.	Asp	Leu	Leu	235	Leu	Asp	Lys	72	0
	240	ASII	ьец	лгр	ser	1rp 245	Phe	Asp	Ile	Thr	Asn 250	Pro	Gly	Ser	Gly	76:	8
atc g Ile v 255	val	GIII (	GTII .	GIN	Asn 260	Asn	Leu	Leu	Arg	Ala 265	Ile	Glu	Ala	Gln	Gln 270	816	5
cac o His I	scu .	ocu (	3111	275	THE	THE	vaı	ırp	280 GTÀ	Ile	ГÀв	Gln	Leu	Gln 285	Ala	864	1
cgc a	.16 1	2 ieu 2	290	PLO (	сту, (	äΤĀ.	Pro	G1y 295	Pro	Trp	Met	Glu	Trp 300	Asp	Arg	912	2
gag a Glu I	TC Y	ac a Asn <i>P</i> 105	ac t Asn T	ac a	acc a Thr s	ser i	ctg Leu : 310	atc   Ile	cac His	agc Ser	Leu	atc Ile 315	gag Glu	gag Glu	agc Ser	960	•

cag Glr	g aa n As: 32	u GI.	g ca n Gli	g ga n Gl	g aag u Ly:	g aad 3 Asr 325	ı GI	g cag ı Glı	g gag 1 Gli	g cto u Le	g ct u Le 33	u Se	t ag r Ar	a cc g Pr	c ggg	1008
335	5	. Me	C AI	a Pile	340	)	) GII	ı val	. Ile	9 Pro	o Me	t Ph	e Se	r Al	c ctg a Leu 350	
ago Ser	gag Glu	r GJ <sup>2</sup> a aad	geo Y Ala	a Co a Thi 359	. PIC	cag Gln	gac Asp	cto Leu	Pro 360	) Ile	gte Va	g cag	g aad 1 Asi	2 at 1 Il 36	c cag e Gln 5	1104
GŢĀ	GII	ı Met	370	HIS	GIT.	Ala	Ile	Ser 375	Pro	Arg	Th:	r Lei	1 Ası 380	n Ala	e ggc	1152
FIO	GLY	385	i rec	GII	i Giu	Gin	390	Gly	Trp	) Met	Thi	395	ı Ası	Pro	c ccc Pro	1200
116	400	val	. сту	GIU	тте	Tyr 405	Lys	Arg	Trp	Ile	11e	e Leu	Gly	Let	g aac 1 Asn	1248
41 <sup>'</sup> 5	TTE	val	Arg	мес	1yr 420	ser	Pro	Thr	Ser	Ile 425	Leu	Asp	Ile	Arc	cag Gln 430	1296
GIÀ	PLO	туя	GIU	435	Phe	Arg	Asp	Tyr	Val 440	Asp	Arg	Phe	Tyr	Lys 445		1344
116	Сув	THE	450	Met	GIU	тув	GIu	Gly 455	Lys	Ile	Ser	Lys	Ile 460	Gly	ccc Pro	1392
GIY	PIO	465	Pro	Pne	Arg	aag Lys	Tyr 470	Thr	Ala	Phe	Thr	Ile 475	Pro	Ser	Ile	1440
ABII	480	GIU	ser	Pro	AIA	atc Ile 485	Phe	Gln	Ser	Ser	Met 490	Thr	Lys	Ile	Leu	1488
gag Glu 495	-10	rrp	GIU	PHE	500	ASI	Inr	Pro	Pro	Leu 505	Val	Lys	Leu	Trp	Tyr 510	1536
cag Gln	цув	1111	MIA	515	GIII	мес	Ата	val	Phe 520	Ile	His	Asn	Phe	Lys 525	Arg	1584
cag ( Gln )	пув	GIII	530	Thr	гÀз	ile (	Gln .	Asn 535	Phe	Arg	Val	Tyr	Tyr 540	Arg	Gly	1632
Pro (	GTA	ccc Pro 545	cag Gln	ctg Leu	ctg Leu	Pne .	atc Ile : 550	cac : His :	ttc Phe	cgc Arg	tcg Ser	cgc Arg 555	cag Gln	cgg Arg	cgg Arg	1680
cgg (	gg	tac	agc	agc	ttg .	atc a	agg (	cgc a	acg (	gtg	cgg	atc	agc	tcc	tcg	1728

Arg	Arg 560	Tyr	Ser	Ser	Leu	Ile 565	Arg	Arg	Thr	Val	Arg 570		Ser	Ser	Ser	
tcg Ser 575	cgg Arg	ctg Leu	tgg Trp	cgg Arg	cag Gln 580	ccg Pro	atg Met	cgg Arg	aag Lys	tgg Trp 585	atg Met	aac Asn	agc Ser	agc Ser	atc Ile 590	1776
agc Ser	Gly	ccc Pro	ggc	ccc Pro 595	gac Asp	atg Met	cgc Arg	gac Asp	aac Asn 600	tgg Trp	cgc Arg	agc Ser	gag Glu	ctg Leu 605	tac Tyr	1824
aag Lys	tac Tyr	aag Lys	gtg Val 610	cag Gln	cag Gln	cac His	ctg Leu	ctg Leu 615	cag Gln	ctg Leu	acc Thr	gtg Val	tgg Trp 620	ggc Gly	atc Ile	1872
aag Lys	cag Gln	ctg Leu 625	gcc Ala	agc Ser	ctg Leu	tgg Trp	aac Asn 630	tgg Trp	ttc Phe	gac Asp	atc Ile	acc Thr 635	aac Asn	tgg Trp	ctg Leu	1920
tgg Trp	tac Tyr 640	atc Ile	aag Lys	atc Ile	ttc Phe	atc Ile 645	atg Met	atc Ile	gtg Val	ggc	ggc Gly 650	ctg Leu	atc Ile	ggc ggc	ctg Leu	1968
cgc Arg 655	cac His	atc Ile	ccc Pro	cgc Arg	cgc Arg 660	atc Ile	cgc Arg	cag Gln	gly	ctg Leu 665	gag Glu	cgc Arg	gcc Ala	ctg Leu	agg Arg 670	2016
gca Ala	gca Ala	tgg Trp	acg Thr	agg Arg 675	gca Ala	ccg Pro	ccg Pro	acg Thr	agc Ser 680	gcg Ala	ccc Pro	ccc Pro	gtt Val	taa	ac	2063
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<220: <223:		onst:	ruct	ence	oding	g po	lyep	itop	e po	lypej	otid	e.				
<400:	> 1	0														
Met A	la (	Cys :	Thr A	Asn (	Cys 1	Cyr (	Cys 1	Lys ]	Lvs (	Cvs (	lvs 1	Dhe I	Jia (	יינים (	Zln	

Met Ala Cys Thr Asn Cys Tyr Cys Lys Lys Cys Cys Phe His Cys Gln 5 10 15

Val Cys Phe Thr Thr Gly Pro Gly Pro Arg Gln Arg Arg Arg Ala Pro 20 25 30

Gln Asp Ser Gln Thr His Gln Val Ser Val Tyr Tyr Ala Ala Ala Gln 35 40 45

Trp Asp Phe Gly Asn Thr Met Cys Gln Ile Asn Pro Gly Arg Ser Gln 50 55 60

Lys Glu Gly Leu His Tyr Thr Cys Val Tyr Gly Pro Gly Pro Pro Cys 65 70 75 80

Asn Lys Cys Tyr Cys Lys Lys Cys Cys Tyr His Cys Gln Val Cys Phe 85 90 95

- Leu Asn Asn Pro Gly Lys Gln Arg Arg Gly Thr Pro Gln Ser Asn Lys
  100 105 110
- Asp His Gln Asn Pro Gly Pro Gly Pro Asn Glu Gln Asp Leu Leu Ala 115 120 125
- Leu Asp Lys Trp Ala Asn Leu Trp Asn Trp Phe Asp Ile Ser Asn Pro 130 135 140
- Gly Ala Cys Asn Thr Cys Tyr Cys Lys Lys Cys Ser Tyr His Cys Leu 145 150 155 160
- Val Cys Phe Gln Thr Gly Pro Gly Pro Arg Gln Arg Arg Ser Ala Pro 165 170 175
- Pro Ser Ser Glu Asp His Gln Asn Leu Asn Pro Gly Asn Glu Gln Glu 180 185 190
- Leu Leu Glu Leu Asp Lys Trp Ala Ser Leu Trp Asn Trp Phe Asp Ile 195 200 205
- Thr Gly Pro Gly Pro His Glu Arg Ser Tyr Met Phe Ser Asp Leu Glu 210 215 220
- Asn Arg Cys Ile Asn Glu Lys Asp Leu Leu Ala Leu Asp Lys Trp Gln 225 230 235 240
- Asn Leu Trp Ser Trp Phe Asp Ile Thr Asn Pro Gly Ser Gly Ile Val 245 250 255
- Gln Gln Asn Asn Leu Leu Arg Ala Ile Glu Ala Gln Gln His Leu 260 265 270
- Leu Gln Leu Thr Thr Val Trp Gly Ile Lys Gln Leu Gln Ala Arg Ile 275 280 285
- Leu Asn Pro Gly Gly Pro Gly Pro Trp Met Glu Trp Asp Arg Glu Ile 290 295 300
- Asn Asn Tyr Thr Ser Leu Ile His Ser Leu Ile Glu Glu Ser Gln Asn 305 310 315 320

Gln Gln Glu Lys Asn Glu Gln Glu Leu Leu Ser Arg Pro Gly Gly Thr 325 330 335

- Met Ala Phe Ser Pro Glu Val Ile Pro Met Phe Ser Ala Leu Ser Glu 340 345 350
- Gly Ala Thr Pro Gln Asp Leu Pro Ile Val Gln Asn Ile Gln Gly Gln 355 360 365
- Met Val His Gln Ala Ile Ser Pro Arg Thr Leu Asn Ala Gly Pro Gly 370 375 380
- Pro Leu Gln Glu Gln Ile Gly Trp Met Thr Asn Asn Pro Pro Ile Pro 385 390 395 400
- Val Gly Glu Ile Tyr Lys Arg Trp Ile Ile Leu Gly Leu Asn Lys Ile 405 410 415
- Val Arg Met Tyr Ser Pro Thr Ser Ile Leu Asp Ile Arg Gln Gly Pro 420 425 430
- Lys Glu Pro Phe Arg Asp Tyr Val Asp Arg Phe Tyr Lys Glu Ile Cys 435 440 445
- Thr Glu Met Glu Lys Glu Gly Lys Ile Ser Lys Ile Gly Pro Gly Pro 450 455 460
- Gly Pro Phe Arg Lys Tyr Thr Ala Phe Thr Ile Pro Ser Ile Asn Asn 465 470 475 480
- Glu Ser Pro Ala Ile Phe Gln Ser Ser Met Thr Lys Ile Leu Glu Pro 485 490 495
- Trp Glu Phe Val Asn Thr Pro Pro Leu Val Lys Leu Trp Tyr Gln Lys 500 505 510
- Thr Ala Val Gln Met Ala Val Phe Ile His Asn Phe Lys Arg Gln Lys 515 520 525
- Gln Ile Thr Lys Ile Gln Asn Phe Arg Val Tyr Tyr Arg Gly Pro Gly 530 540
- Pro Gln Leu Leu Phe Ile His Phe Arg Ser Arg Gln Arg Arg Arg 545 550 555 560
- Tyr Ser Ser Leu Ile Arg Arg Thr Val Arg Ile Ser Ser Ser Arg

565 570 575

Leu Trp Arg Gln Pro Met Arg Lys Trp Met Asn Ser Ser Ile Ser Gly
580 585 590

Pro Gly Pro Asp Met Arg Asp Asn Trp Arg Ser Glu Leu Tyr Lys Tyr 595 600 605

Lys Val Gln Gln His Leu Leu Gln Leu Thr Val Trp Gly Ile Lys Gln 610 620

Leu Ala Ser Leu Trp Asn Trp Phe Asp Ile Thr Asn Trp Leu Trp Tyr 625 630 635 640

Ile Lys Ile Phe Ile Met Ile Val Gly Gly Leu Ile Gly Leu Arg His 645 650 655

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